The Ferns and Their Distribution at Douglas Lake, Michigan[1]

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Douglas Lake is located in Cheboygan County, Michigan, seventeen miles south of the Straits of Mackinac. The region is generally level to rolling and has a gentle slope to the southwest. It is drained by many small streams running into Burt Lake two miles to the South and thence into Lake Huron. The topographical outlines of the region are due to the joint action of the moving ice and flowing water during the glacial period.

The climate, as in nearly all the upper part of the lower peninsula, is rigorous in winter and subject to very frequent, sudden and extreme changes of temperature, as much as 50 degrees F. variation being recorded for a period of 24 hours. This sort of weather undoubtedly has much influence on the vegetation exposed above the snow, but since the ferns are covered with a dense layer of snow they are well protected from early winter until late spring. With the melting of the snow, the ferns begin growing vigorously and continue well into the summer. The early summer's climate is ideal for the growth of ferns. Showers are frequent and, combined with the average temperature of 68 F. to 70 F., no better place can be found in the extreme northern parts of the Central States for the collection of wild ferns.

Moraines thoroughly permeate the whole region in all directions and to a large extent determine the flora. Topographically considered, and for convenience, the region will be discussed under the three following topics: (1) The Pine Plains, (2) The Hardwoods and (3) The Bogs.

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[1] Read before the Michigan Academy of Science March 29, 1916.

THE PINE PLAINS

This is the most extensive of the three proposed areas. It is characterized by its sandy soil, the sand in some places being estimated at many feet in depth. This region once supported a heavy growth of Red and White Pine. Since the cutting off of this timber, which occurred about 30 to 35 years ago, forest fires have cleared the plains of brush and small trees and at the present time the region is covered with a dense growth of Fire Cherry, Red Oak, American Aspen, and Large-toothed Aspen, the last species predominating.

The floor of this thicket is covered with a dense growth of *Pteris aquilina*, *Diervilla lonicera* and *Gaultheria procumbens*, the *Pteris* being most abundant of the three. *Pteris aquilina* was the only fern found growing in the pine plains. This particular species, especially in this region, prefers a sandy soil, and particularly so, if perchance it has been burned over. The manner of propagation, by means of underground rhizomes is very rapid and efficient. In no case were the gametophytes found. Considering that *Pteris* fruited more abundantly than any other species, the only reason to account for the complete absence of gametophytes was the extreme dryness of the soil.

Fires usually do very little injury to this fern as its rhizomes are about eight inches beneath the surface of the earth. The rhizomes are dichotomously branched and as they die away at the older end, the lateral branches become separated from the parent plant, the separated rhizome serving as a starting point for a new plant. In this manner does the Bracken Fern become disseminated more widely.

The Bracken Fern takes very kindly to the intense sunlight of the sandplains and a very pronounced line of demarcation is noted at the edge of the woods. Rarely does one find the Bracken Fern growing in the dense

woods in any abundance. It is sometimes found in swales and swampy thickets, and here the plant will sometimes be found to grow to a height of five feet. In the open Pine Plains the Bracken usually measures about two to three feet in height.

THE HARDWOODS

The hardwoods are usually found on the higher elevations and there is a very striking difference between the soil composition of this region and that of the pine plains. The distribution of the hardwoods seem to be governed by the amount of clay and humus in the sand. The more clay, the greater the forest growth and the more pronounced is the fern flora. The entire floor of the forest is covered with a layer of leaf mold to a depth of several inches. The hardwoods are well drained but are always moist beneath the vegetable mold.

Very few areas of the original hardwoods remain untouched, the last active lumbering taking place about 1912. After the timber was cut off, the area grew up to brambles, red-berried elder and if perchance it were burned over, it grew up to *Epilobium angustifolium* and *Erechtites hieracifolia* and, in several places, the areas have been cleared for farming land. The effect of the lumbering and the fires is very noticeable on the distribution of the flora especially that of the ferns. Before the advent of the lumberman and the forest fire, a number of species of ferns were to be found in all the hardwoods, but at the present time the only species to be found in these cut and burned over areas are *Pteris aquilina*, *Polypodium vulgare*, *Phegopteris dryopteris*, and *Adiantum pedatum*. *Polypodium vulgare* was found in but one place and then only on a moderately high bank overlooking Douglas Lake to the north.

About two miles southeast of Douglas Lake on the west shore of Burt Lake, there still stands a tract of

forest growth which represents the condition of the cut over areas in the past. This tract of hard maple, sweet birch, and hemlock offers the best kind of a home for the ferns of this region. Here are to be found 17 of the 24 species of ferns reported for this region. Owing to the protection offered by these woods, the ferns grow very luxuriantly. Among the largest and most stately is Goldie's Fern, *Aspidium Goldianum*. *Cystopteris bulbifera* was found with fronds three feet long and some of these fronds bore from 25 to 35 bulbils. This species loves a very wet place and in these woods was found most abundantly in the ravines close to the water's edge. *Cystopteris fragilis*, unlike its sister species, was found only in the drier locations and this was at the source of the ravines. Higher up on the sides of the ravines, *Asplenium filix-foemina*, the Lady Fern, was found growing in considerable numbers.

Aspidium Goldianum, the largest and most beautiful fern of the region, was found in one station in the summer of 1913 by Professor Smith and in the summers of 1914 and 1915, the writer found them in a large number of new stations, all of them however, in about the same kind of location, moderately moist and shady. *Onoclea Struthiopteris* was found in but one place. This region was along the edge of the Burt Lake woods where a very small area was cleared and fenced off for a pasture. These ferns were browsed off by the cattle each year and the growth for the summer of 1915 was about one half that of 1914. *Adiantum pedatum* was found growing in greatest abundance on upturned soil due to the felled trees.

THE BOGS

Under this heading will be discussed the swamps, marshes and swales. A typical bog in this region is characterized by its growth of Tamarack and Arbor Vitae. The soil is usually acid in reaction and poorly

drained, the majority of the species of plants belonging to the Ericads. The trees are *Larix laricina, Thuja occidentalis, Picea canadensis, Picea mariana* and *Taxus canadensis.* The floor of the densely covered bog consists of several species of *Sphagnum* and only in the open and more or less partially cleared areas are the sedges, grasses and liliaceous plants to be found. The trails which were cut through the bogs by the lumbermen represent about the only regions where the ferns grow in any abundance. Sometimes they are to be found rather plentifully along open streams which penetrate the bog. The fern seldom migrates far into the densely shaded areas and but few of the hardwood species are found. The most common species to be noted was the *Aspidium thelypteris* which does not occur in the hardwoods. Of the *Osmundas, regalis* and *cinnamomea* were found in considerable abundance in nearly all the bogs and usually in the more open areas. *Osmunda Claytoniana* was never seen by the writer in this region but was reported by Professor Smith from Smith's Bog. Scattered throughout the bog were *Aspidium cristatum, Phegopteris polypodioides, Phegopteris dryopteris, Aspidium noveboracense, Botrychium virginianum* and, in 1914, *Ophioglossum vulgatum* was found for the first time. No other species have been found since the discovery of this fern and yet it is quite possible that some species have escaped the eyes of the investigator. *Botrychium virginianum* was the most abundant in the shady areas and presented a great range in size. The smallest of them were not more than 10 cm. high and at times were difficult to distinguish from mature *Botrychium simplex* which did not grow in this region. Another striking feature concerning *Botrychium virginianum* was that it was just as likely to be found growing in the richest woods to a height of three feet as it was in the cold bogs where the soil was extremely acid and cold.

The marshes differ considerably from the bogs, especially in their formation and their location. They are not, as a rule, covered with a dense growth of trees but their vegetation consists largely of shrubs and herbaceous plants. The marsh fern, *Aspidium thelypteris*, is the most common species, while *Osmunda regalis*, *O. cinnamomea*, and *Onoclea sensibilis* are to be found scattered about the swamps in no definite order. The *Osmundas* are usually found growing very abundantly and luxuriantly near the shaded banks of small streams and it is a very common thing to find them three and a half to four feet high.

FERN VARIATIONS

But one plant of *Cystopteris bulbifera* was found in 1914 which showed any abnormal branching. This plant produced a frond which had a simple stipe, but at the junction of the first pair of pinnae, the stipe divided so that two well formed laminae were produced above the first pair of pinnae. It was also interesting to note that each frond bore bulbils as if a normal frond.

Besides the young plants of *Botrychium virginianum* of the Bogs, it was noticed that the young plants of *Botrychium ternatum intermedium* of the hard woods so resembled the young plants of *B. virginianum* that it was sometimes difficult to tell the species.

The ferns found growing in each of these regions are as follows:[2]

PINE PLAINS: *Pteris aquilina* L.

HARDWOODS AND CLEARINGS: *Polypodium vulgare* L., *Phegopteris polypodioides* Fée, *Phegopteris dryopteris* (L.) Fée, *Adiantum pedatum* L., *Pteris aquilina* L., *Asplenium filix-foemina* (L.) Bernh., *Aspidium Goldianum* Hook., *Aspidium spinulosum*, (O. F. Muller) Sw., *Cystopteris bulbifera* (L.) Bernh., *Cystopteris fragilis* (L.) Bernh.

[2] Nomenclature as in Gray's Manual, Seventh Edition.

Onoclea sensibilis L., *Onoclea Struthiopteris* (L.) Hoffm., *Botrychium lanceolatum angustisegmentum* Pease & Moore, *Botrychium ramosum* (Roth) Aschers., *Botrychium ternatum intermedium* D. C. Eaton, *Botrychium ternatum rutaefolium* (A. Br.) D. C. Eaton, *Botrychium virginianum* (L.) Sw.

BOGS AND MARSHES: *Phegopteris polypodioides* Fée., *Phegopteris dryopteris* (L.) Fée, *Aspidium Thelypteris* (L.) Sw., *Aspidium noveboracense* (L.) Sw., *Aspidium cristatum* (L.) Sw., *Cystopteris bulbifera* (L.) Bernh., *Onoclea sensibilis* L., *Osmunda regalis* L., *Osmunda Claytoniana* L., *Osmunda cinnamomea* L., *Ophioglossum vulgatum* L., *Botrychium virginianum* (L.) Sw.

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Standley's Ferns of Greene Co., Mo.

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I have recently read the interesting paper on the Ferns of Greene County, Missouri, by Mr. Standley, in the AMERICAN FERN JOURNAL for April–June, 1916, and I think a few remarks on the introduction and the notes under several species will be very appropriate here.

In the introduction Mr. Standley gave a short account of the topography, the characteristic rocks and soil, and the names of a few characteristic and extra-limital plants.

It was my good fortune many years ago to have been able to collect in Greene County, Missouri, in company with Mr. Blankinship and Prof. Shepard, and it was on one of my trips there with the former, that the last species mentioned by Mr. Standley, *Othake callosum*, was discovered in Greene County, though at that time I little dreamed that this interesting composite would be later on associated with my name.